

DIETMAR PRZYTULLA, a citizen of Germany, whose residence and post office address is Gustav-Heinemann-Strasse 64, 50170 Kerpen, Germany, has invented certain new and useful improvements in a

PALLET CONTAINER

of which the following is a complete specification:

PALLET CONTAINER

CROSS-REFERENCES TO RELATED APPLICATIONS

[0001] This application claims the priority of German Patent Applications Serial Nos. 200 09 265.0, filed May 25, 2000, and 200 17 895.4 filed October 18, 2000 the subject matter of which is incorporated herein by reference.

[0002] This application claims benefit of prior filed provisional application Appl. No. 60/245,332, filed November 2, 2000.

[0003] This application is a continuation of prior filed copending PCT International Application No. PCT/EP01/05789, filed May 21, 2001.

BACKGROUND OF THE INVENTION

[0004] The present invention relates to a pallet container having a thin-walled rigid inner receptacle made from thermoplastic material for the storage and transport of liquid or free-flowing goods, wherein the plastic container is closely surrounded by an outer cage jacket as a supporting casing of crossed hollow bars and a bottom pallet on which the thermoplastic receptacle is supported and which is firmly connected to the supporting casing.

[0005] Pallet containers of the type having welded hollow bar support jackets are generally known, as for example in EP 0 734 987 A (Sch). The hollow bar support jacket of the pallet container disclosed there consists of hollow bars having a circular shaped profile that are highly compressed at the welded intersection points. From DE 297 19 830 U1 (vL) another pallet container is known having hollow bars with a different cross sectional configuration, which specifically have a uniformly shaped cross sectional profile throughout the entire length of the bar without any dimples or dents designed to reduce the shape of the cross sectional profile of the bar. A further pallet container with a cage that has open hollow bars is known from the DE 196 42 242. As disclosed there, the straight surfaces are laterally flanged outwards and welded together in the area where the cage bars intersect. The openly profiled cage bars possess a slight torsional stiffness making it difficult to manually handle the pallet container due to the thin relatively sharp-edged outer flange. Furthermore, various pallet containers with cage bars having a square shaped cross section are also known from the prior art.

[0006] The attachment of the cage jacket at the bottom pallet which may be configured as a flat pallet from plastic or wood or as a hollow steel bar frame, is usually realized by attachment means such as for example, screws, brackets, clamps or grips that engage with the lower horizontal and circumferentially extending cage bars. These attachment means are either nailed, riveted, screwed or welded to the upper plate or the upper outer edge of the pallet.

[0007] Pallet container for use in industrial applications or when the pallet containers are utilized in the chemical industry, they have to pass a governmental approval inspection and fulfill various quality controls. For example, the filled pallet containers have to undergo interior pressure tests as well as drop tests from specific heights. Pallet containers or combination –IBCs (IBC=Intermediate Bulk Container) of the type discussed here –with a filling volume of usually 1000 liters-, are preferably used in the transport of liquids. Particularly when transporting filled combination-IBCs by truck, considerable gushing motions of the liquid container content occur that are due to transport shocks and the movement of the transport vehicle- particularly, when travelling on bumpy roads, thereby exerting constantly changing pressure forces on the interior receptacle walls, which in turn lead to radial vibrational motion of the cage jacket (dynamic continuous vibrational stress). Depending on the configuration of the cage jacket during long transports over bad roads, stress builds up which causes fatigue in the cage bars as well as breakage. Consequently, such pallet containers are not suitable, for example for export to the USA, or for multiple usages.

[0008] The embodiment in the afore-described EP 0 734 967 A suffers from drawbacks such that the circular hollow profile of the horizontal and vertical cage hollow bars, specifically in the area of the intersecting points, are prone to considerable deformation specifically at the welding points and thus exhibits a markedly reduced section modulus as compared to other areas. Additionally, because the circular hollow bar profile is even deeper dimpled next to the dimples

for the welding points, the bar is further weakened and consequently, in the area of the dented hollow bar profile, the material becomes brittle through welding.

SUMMARY OF THE INVENTION

[0009] According to one aspect of the present invention, an improved pallet container is provided which is designed to obviate the afore-stated shortcomings and drawbacks and which is configured such that an improved transport strength and improved resistance against transport stress and against long-term vibrational motion stress is provided.

[0010] Another aspect of the present invention is to provide a pallet container suitable for transporting dangerous liquids or free-flowing loading goods up to the highest standard of approval quality.

[0011] As a further aspect of the present invention, the pallet container should be suitable for transporting dangerous liquids or free-flowing loading goods up to the highest standard of allowable levels; and while fulfilling normal transport needs, a configuration of the cage jacket with fewer vertical and/or horizontal cage bars without loss in its mechanical stability should be realized.

[0012] These aspects, and others which will become apparent hereinafter, are attained in accordance with the present invention, wherein the pallet container has a cage jacket of vertical and horizontal steel hollow bars wherein the cage

bars have a trapezoid-shaped cross section with a closed profile and having longer and shorter parallel extending side walls and two straight side walls which extend obliquely relative to each other, and which, starting from the longer of the parallel side walls that are extending obliquely towards each other, connect to the shorter wall, and wherein the two straight side walls that are extending obliquely relative to each other form a crown angle of approximately 20° to 45°, preferably about 36°. The trapezoid-shaped closed profile of the hollow bar possesses a high bending section modulus and a high torsion-section modulus due to the profile sidewalls being positioned in a slightly oblique manner relative to each other. This is realized particularly when the height to width (H/B) ratio of the trapezoid-shaped tube profile is in the range of 0.8 to 1.0, preferably about 0.86. With the pallet container according to the invention, a cage jacket can be realized which sustains foreseeable normal transport stress and which is configured having a total of only 5 instead of 6 of the horizontal cage bars but without noticeable loss of mechanical load carrying capacity.

[0013] In one embodiment of the present invention, partially in the area the intersection of two cage bars, the longer parallel side wall of the cage bar with the trapezoid-shaped profile is dimpled inwardly along a length of approximately twice the width of a cage bar in such a manner, that the two outer longitudinal edges form a convexity so that four points are formed at each intersection of the vertically and horizontally extending cage bars and that are firmly joined after welding, whereby in each of the cage bar intersections the longer parallel walls facing each

other are not contacting each other even after being welded.

[0014] In a preferred embodiment, the longer of the parallel walls of the cage bar with a trapezoid-shaped profile is dimpled inwardly along its entire length (= continuous longitudinal indenting or profiling) such that the two outer longitudinal edges are formed with an outwardly extending convexity (bulging), wherein at each intersection of the horizontally and vertically extending cage bars four contact points are formed which are firmly connected after being welded, so that the (longer) opposing parallel walls are at a distance from each other even after being welded and without contacting each other. In prototypes, the trapezoid-shaped cage bars, which are dimpled along their entire length, have proven especially outstanding in their use.

[0015] In a variation of the embodiment, the longer parallel wall of the trapezoid profiled hollow bar is inwardly dimpled only partially in the area of an intersection and the longer parallel wall of the other trapezoid-shaped hollow bar is inwardly dimpled along the entire length. This configuration may prove to be already entirely sufficient for the average stress load. The depth of the profiling dimple of the longer parallel wall amounts to approximately one to two times that of the wall thickness of the hollow bar profile (about 1mm to 2mm); in an actual pallet container, the hollow bar profile wall thickness is 1mm and the depth A of the dimple is also 1mm, so that after welding - whereby the contact points of the crossed cage bars melt into each other by about 1mm – at each point of intersection, the long parallel walls facing each other are still spaced apart from

each other by about 1mm and are not in contact with each other even after welding. This is particularly important because oftentimes pallet containers are stored outdoors and are thus exposed to the elements of weather. By providing a distance between the cage bars at the points of welding, accumulating rainwater can easily dry off and formation of rust is thereby substantially prevented. If the welding surfaces were in contact, the formation of rust would be unavoidable leading to extensive rusting of the cage bars within a short time.

[0016] In a further and special configuration of the present invention, at least one dimple is provided at the side of the longer parallel wall of the trapezoid-shaped hollow bar laterally at a distance from each of the welding points. This dimple reduces the height of the hollow bar H , and thereby relieves the dynamic vibrational stress and the critical peaks of the various bending stresses that bear on the sensitive welding points. Furthermore, in accordance with the invention, at each side of the trapezoid-shaped hollow bars, next to the welding point, a dimple is provided, which is spaced at a distance of at least one tenth of the width B of the hollow bar. Thus, during occurrence of the dynamic vibrational stress, the critical tension peaks are shifted away from the welding points to adjacent areas at a distance thereto. By means of providing the hollow bars with the special configuration, a substantial reduction in static or dynamic stress on the welding connections is realized, which is due to the peak stress reducing dimples in the hollow bars provided laterally at a distance to the welding points, so that the welding points are arranged not to be in a deformation zone, in order to retain their

high flexural strength. The following special features relate to the gist of the invention: In contrast to the known hollow bar profiles, the hollow bars according to the invention are not partially dimpled at the welding points, but the respective dents or dimples are provided at a distance from the welding points at the same side and/or the opposite side of the hollow bar in order to reduce the bending section modulus relative to the intersecting points and to relieve the welding points of the cage bars of static and/or dynamic stress. The trapezoid-shaped profile is configured in such a manner, that dimpling can be carried out easily and without extensive material displacement. Only specific regions of the cage hollow bars are dimpled, respectively dented or indented corresponding to a purposeful formation of "vibration elements", thereby effecting relief against vibrational stress and the fluctuating flexural tension peaks on the welded intersection or the four welding points. When welding one hollow bar together with a second hollow bar, stiffening of the hollow bar and a corresponding material brittleness occurs at that location, thereby making the hollow bar particularly sensitive against vibrational stress at exactly this point. Considerable vibrational stress, which occurs, for example, during transportation by truck can lead in the shortest time to breakage of the welding points or of the hollow bars at the welding points. In accordance with the invention, the cage jacket is configured such that the "wanted vibration points" are not exactly at the intersecting points or in the proximate zone thereof but at least a short distance away from the welding points of the intersection. The wanted vibration points which are established by forming the dimples are in any event less than 50% of the cross section of the hollow bar. They are arranged in the range.

of 10 % to 45% of the height level of the hollow bar cross section, preferably at about 1/3 (33%). While this causes only a very measured reduction of the flexural strength of the dimpled hollow bars, susceptibility of the hollow bars to fracturing due to fatigue is considerably reduced.

BRIEF DESCRIPTION OF THE DRAWING

[0017] The invention is explained and described in greater detail hereinafter with reference to embodiments, which are illustrated in the drawings. It is shown in:

[0018] FIG. 1 a front view of a pallet container according to the invention;

[0019] FIG. 2 a side view of a test-pallet container;

[0020] FIG. 3 an sectional illustration on an enlarged scale of the trapezoid-shaped hollow bar profile according to the invention at a hollow bar intersecting point;

[0021] FIG. 4 a further sectional illustration on an enlarged scale of a preferred trapezoid-shaped hollow profile at a hollow bar intersecting point;

[0022] FIG. 5 a schematic sectional illustration of a hydro-dynamic

pressure effect of a liquid load on the container side- wall;

[0023] FIG. 6 a horizontal partial sectional illustration of a point of greatest outward deflection of the cage;

[0024] FIG. 7 an enlarged illustration of an intersection of hollow bars with dimples;

[0025] FIG. 8 a trapezoid-shaped cross section of a hollow bar according to view D of FIG. 7;

[0026] FIG. 9a a dimpled trapezoid-shaped cross section of a hollow bar (narrow side) along line C-C;

[0027] FIG. 9b a dimpled trapezoid-shaped cross section of a hollow bar (broad side) along line C-C;

[0028] FIG. 10 a square shaped profile of a cross section of a hollow bar – in unstressed condition;

[0029] FIG. 11 the square shaped profile of a cross section of a hollow bar according to FIG. 10 in an over-stressed condition;

[0030] FIG. 12 a profile of a hollow bar according to the invention – in unstressed condition;

[0031] FIG. 13 the profile of a hollow bar according to the invention according to FIG. 12 – in stressed condition;

[0032] FIG. 14 another hollow bar profile according to the invention;

[0033] FIG. 15 a further hollow bar profile according to the invention;
and

[0034] FIG. 16 a partial top view of a corner arc of the hollow profile according to the invention.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0035] This is one of two applications both filed on the same day. Both applications deal with related inventions. They are commonly owned and have the same inventive entity. Both applications are unique, but incorporate the other by reference. Accordingly, the following U.S. patent application is hereby expressly incorporated by reference: "Pallet Container"

[0036] Throughout all the Figures, same or corresponding elements are generally indicated by same reference numerals.

[0037] Turning now to the drawing, and in particular to FIG. 1, there is

shown a pallet container according to the invention referenced with numeral 10, which shows a thin-walled blow-molded rigid inner receptacle 12 made of thermoplastic material (HD-PE) with an upper input opening and a cage of intersected hollow bars 14 closely enveloping the inner receptacle, and which is firmly – but detachably or interchangeably connected to the bottom pallet 16. The front view as depicted exhibits the narrow side of the pallet container 10 with an exit valve disposed at the plastic receptacle 12 near the bottom. The lower front edge of bottom pallet 16, here shown in configuration as a wooden pallet (US Runner), with the exit valve 18 situated above, represents the most vulnerable point of the pallet container, which is exposed to the greatest stress during approval testing, especially during the diagonal drop test. The special configuration of the cage bars with dimples (cf. FIG. 7) are shown in the circles.

[0038] Prior to the development of the pallet container according to the invention, five different pallet containers known and available on the market were submitted to the precise comparative stress tests (interior pressure test, drop tests, vibration tests, test for pressure capacity upset, respectively test for stacking capacity). In serial vibration tests during simulation of long haul truck transport on bad roads, certain especially frequently occurring weak points in various cage jackets were isolated.

[0039] The test pallet container 10 (here shown without the elasticity promoting dimples) shown in FIG. 2, which for testing purposes was also

deliberately submitted to continuous overload testing, is shown with circles drawn to illustrate those points marked at the horizontal and vertical cage bars, which fail and begin to break first according to the comparative testing results during dynamic vibration stress, (cf. FIG. 10, 11).

[0040] FIG. 3 shows an area of intersection of a cage bar 18 having a closed profile in accordance with the invention, a trapezoid-shaped cross section, a longer wall and a shorter wall extending parallel to each other 20, 22 and the two straight walls 24 extending obliquely relative to each other, and beginning from the longer parallel wall 22 that extend obliquely connect to the shorter wall 20, whereby the two straight side walls of profile 18 which extend obliquely relative to each other form a crown angle 26 of between 20° and 45° , preferably about 36° . The ratio of height to width of the trapezoid-shaped profile of the hollow bar is between 0.8 and 1.0, – preferably about 0.86. Due to the relatively great height of the trapezoid-shaped profile (without dents in the oblique side walls) a correspondingly high flexural stiffness is realized, and due to the closed and compact configuration of the trapezoid-shaped profile, the hollow bars exhibit an improved torsional stiffness as compared to hollow bar profiles that are configured with a circular profile or those having an open profile. The distance of the intersection of the extended horizontal axis of the walls 24 extending obliquely relative to each other at crown angle 26 is about the height H of the profile or, measured beginning from the longer parallel wall 20 is about 2H. The distance can be of between 0.75 and 2.5 H.

[0041] A preferred trapezoid-shaped profile 18 is depicted in FIG. 4. In a simple manner, the longer parallel wall 22 is only partially inwardly dimpled in the area of the intersection of two hollow bars in such a manner that at each of the two outer longitudinal edges a convexity 28 is formed that bulges outwardly, so that at each intersection of the horizontally and vertically extending hollow bars, four contact points are formed, which after being welded, are firmly connected to each other, so that the longer parallel walls 22 in each hollow bar intersection are still spaced from each other even after welding.

[0042] In an especially preferred embodiment, the longer parallel wall 22 is dimpled inwardly along the entire length of the hollow bars, whereby the two outer longitudinal edges are provided with an outwardly bulging convexity 28. The hollow bar with the dimpled trapezoid-shaped profile 18 along the entire length of the bar has proven outstanding in the prototypes and is being manufactured from a hollow bar having a diameter of 18mm (56.55mm in circumference). The depth of the dimple of the longitudinal profile should be about once or twice that of the wall thickness of the hollow bar, about 1mm to 2mm; and in an actually built pallet container the wall thickness of the hollow bar is 1mm and the depth of the dimple 1 mm. The welding at each of the four contact points at each intersection of the hollow bars is carried out by means of electrical resistance pressure welding. When carrying out the four-point welding, the crossing cage bars are being pressed together about 1mm, so that the opposing parallel walls 22 in each intersection are still distanced from each other by about 0.5 mm to 2mm,

preferably, about 1mm and are not in contact with each other even after being welded. (distance $A = 1\text{mm}$). This is a particularly important aspect, since pallet containers oftentimes are stored outdoors and are exposed to the weather. By distancing the cage bars from each other at the welding points, rainwater which might accumulate there dries off by exposure to air and thus, rusting is substantially prevented. Welding surfaces that are abutting each other are inevitably prone to formation of rust, which can lead to heavy rusting of the entire cage in the shortest time. Illustration of the cross section also clearly shows that the width of the "longer" parallel wall 22 that remains between the outwardly bulging edges 28 is approximately the same as the width B1 of the opposite, shorter parallel wall 20.

[0043] The schematic representation of FIG. 5, illustrates the changing deforming deflection of the cage jacket due to dynamic vibrational stress. The hydrostatic interior pressure of the liquid goods load - illustrated in the right hand side in FIG. 5 causes the maximal cage deflection D_a, D_i occurring approximately at the level of the center of gravity S of the loaded goods, which means at about 33% of the cage height, and at that level the vibration amplitude toward the outside is approximately two times that of the inside, which is the reason the greatest danger of crack formation in the cage hollow bars during vibrational stress is in the area of the lower half of the cage.

[0044] The schematic representation of a partial sectional view in FIG. 6

illustrates the horizontal cross section at the location of the maximal deformation effect D_a and D_i . There is no interference of vibrational deflection directed towards the outside, while inside the liquid column encounters the opposite sidewall. The lower circumferential horizontal cage bars 30 are thus submitted to great bending stresses particularly, in the vicinity of the corner bends 38.

[0045] FIG. 7 shows – in an interior view of the cage - the intersection 36 of a horizontal hollow bar 30 with that of a vertical hollow bar 32. In the intersection 36, the four welding points are indicated with points. The trapezoid-shaped hollow profile of horizontal bar 30 and that of the vertical bar 32 is provided each with one dimple 34 at each side exactly next to the intersection 36, respectively the four welding points, whereby the dimples 34 are distanced to the point of intersection 36 by at least one tenth of the hollow bar width B. View D of the non-deformed trapezoid-shaped profile 18 is shown in FIG. 8 and an illustration of the dimple 34 along the line C-C is shown in FIG. 9. The dimples 34 in the hollow bar can be made on the side of the “longer” parallel wall 22 or/and on the side of the opposing “shorter” parallel wall 20. Thus, numerous variations may thereby be realized, so that between two cage bar intersections at least two dimples may be provided at the outer side of the trapezoid-shaped profile or/and two dimples may also be provided at the inner side. Significant is however in all these embodiments, that the hollow bars are not dimpled or deformed directly at the point of intersection or respectively at the welding points, but only at a distance to them. When reducing the height H of the profile, the depth T of a dimple 34

should be kept low if possible, i. e. in the range of 15% to 50%; in a preferred embodiment, the depth T of the dimple is about 33% of the height H of the profile. The longitudinal extension of dimple 34 along the bar should be in the range of about one and one half to three times the width B of the profile, in a preferred embodiment, the longitudinal extension of a dimple 34 is about twice that of the profile width B.

[0046] FIG. 10 shows a hollow profile of the known type having a square shaped profile along the entire length of the bar in an unstressed condition. After already a relatively short period of dynamic vibrational stress, formation of a crack is seen on the horizontal bar 30' directly at the intersection, respectively at the welding points, as is illustrated in FIG. 11.

[0047] The formation of cracks or respectively, the tearing of the cage bars always occurs in the area of highest pull tensions, or at the location where the greatest bulging of the cage jacket occurs. The vertical hollow bars are arranged at the inside of the cage jacket and the horizontal hollow bars are arranged at the outside. Cracks and fracture points always occur in the area of the intersection directly next to the welding points (cf.-circled views in FIG. 2). Cracks start forming at the vertical hollow bars – and relative to the jacket dimension - always travel from the outside to the inside and always start on the inside of the horizontal bars travelling to the outside. In comparative tests, it has been found that the cage jackets made from cage bars with an open profile and provided with flat outwardly

flanged edges, while exhibiting good stacking capacity because the welding points are relatively far part from each other within the intersection, they react most unfavorable to vibrational stress.

[0048] In contrast to the square shaped hollow profile, FIG. 12 shows a closed trapezoid-shaped hollow profile 18 in accordance with the invention with two dimples 34 in a horizontal bar 30. As illustrated in exaggerated manner in FIG. 13, crack formation does not occur even after prolonged exposure to vibrational stress. The reason for this is on the one hand, that there are no weakness-inducing dimples at the welding points in the intersecting area, which therefore remain very stable, while on the other hand, the dimples 34, when provided at least at a small distance from the intersection, so as to reduce the bending section modulus, function as a kind of "bending hinge", whereby they act to prevent the peak tensions impacting upon the sensitive welding points and shift the peak tensions away to more distant flexible areas.

[0049] The special problem in constructing a particular embodiment of a cage jacket is that the vertical and horizontal cage bars should be as stable and rigid as possible in order to prevent excessive bulging of the pallet container, for example such as occurs through interior pressure; and on the other hand, a high bending section modulus should be provided to counteract constant dynamic vibrational stress, wherein the two afore-mentioned criteria operate in opposite directions. Under consideration of favorable, i.e. low production costs, an optimal

solution must be found. According to the latest trends according to the invention, the known pallet containers having cage bars with an even profile along the length of bar, as for example according to DE 297 19 830 U1 are perhaps suitable as a storage container but are not suitable as containers for carrying dangerous liquid loads and submitted to dynamic vibrational stress.

[0050] The afore-cited patent publication is based on the prior art insofar as the known pallet container has a cage jacket made from hollows with a circular cross section that are provided with dimples at least at the welded hollow intersections. A statement on page 2 of that patent disclosure which states “....by using a profiled hollow (there) according the invention (without any localized dimples) local tension accumulation is avoided....” does not correctly state the latest trends in the present invention and simply shows that the effect of the reciprocal connection between flexural strength and vibration elasticity have not been taken into account when such cage jackets of pallet containers are submitted to transport stress.

[0051] The depth T of the dimples 34 in the trapezoid-shaped profile according to the invention are between approximately 25% and 50%, preferably approximately 33% of the height H of the hollow bar profile. A dimple of 5mm (=33%) is generally sufficient when made in a hollow having a height of 15mm, whereby the vibrational stress at the welding points is either kept low or is eliminated while retaining a sufficiently high rigidity in the hollow. This rigidity is

important in order to keep the vibration amplitude of the lateral bulging of the vibrating cage at a low level.

[0052] FIG. 14 illustrates an embodiment having two dimples 34 at the side of the hollow bar profile facing away from the welding points illustrated with the short parallel wall 20, and which - as is shown in FIG. 15 – represents a modified and particularly useful variation of that embodiment. The trapezoid-shaped hollow profile 18 is provided with dimples 34 each, at the side of the shorter parallel wall 20, and on the side of the longer parallel wall 22 laterally next to an intersecting point 36 in such a manner, so that the dimples are exactly opposite each other. The dimples are spaced here at a distance of approximately one tenth of the width B of the hollow bar profile from the intersecting point 36. Placing the dimples 34 in each of the parallel extending sidewalls 20, 22, particularly enhances the “hinge effect” or the elasticity of the hollow profile.

[0053] According to the technical teaching of the present invention, the configuration of the dimples 34 in the horizontal and vertical hollow bars 30, 32 can be of different depth depending on the intensity of the dynamic stress expected to bear on the cage jacket 14. Thus, in accordance with specific demand or need, while retaining sufficient flexural strength, the optimal vibrational elasticity in the horizontal and vertical hollow bars can be controlled in various areas of the cage jacket, for example in the longer side walls, or the shorter front and rear walls of the pallet container.

[0054] FIG. 16 illustrates a further important embodiment for reducing the bad effects of the dynamic vibrational stress on the horizontal hollow bars. In the region of the 90° bent corner areas and parallel to a vertical direction, the horizontal hollow bars 30 of the cage jacket 14 are flattened such that they also act as a hinge-type “bending joint”. The horizontal hollow bars need not possess a high bending resistance; in their corner areas, respectively perpendicular to the vertical; of greater importance here is a higher elasticity. Particularly favorable test results were realized with pallet containers that have horizontal hollow bars 30 which are flattened in the corner areas 38 of support jacket 14 from the inside and/or from the outside by at least one fourth of the height H of the diameter of the profile 18. In one of the embodiments actually built, the horizontal hollow bars in the lower region of the cage jacket are flattened from the inside by about 20 % and from the outer corner arc by about 35%, while of flattening in the upper region of the cage jacket are configured so they are incrementally reduced.

[0055] At this point it should be pointed out, that the essential features of the invention are rendered schematically and in an exaggerated way in the patent drawings, which should not be interpreted as limiting but merely for purposes of illustration and better understanding by the viewer.

[0056] It is understood that the variations as shown can be combined in various ways and that other combinations are also within the spirit of the invention.

[0057] The above-presented possible variations, particularly the lower region of the cage jacket can be provided with different means for realizing sufficient flexural strength with optimal suitable hollow bar elasticity.

[0058] While the invention has been illustrated and described as embodied in a pallet container, it is not intended to be limited to the details shown since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

[0059] What is claimed as new and desired to be protected by Letters Patent is set forth in the appended claims: